



CleanFuelsOhio

Heavy Duty Fleets:

Retrofitted, Refueled and funded for a Cleaner Ohio

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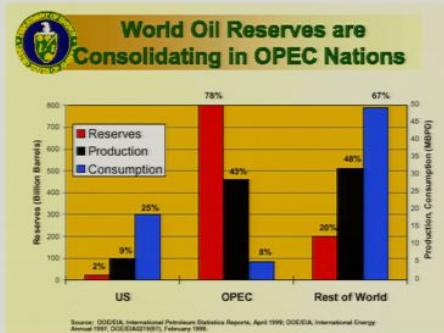


Overview

- Why Alternative (or American) Fuels
- Myths and Facts
- Biodiesel
- Natural Gas
- Propane
- Heavy Duty Hybrids



Why Cleaner Alternative Fuels?





Myths and Facts

1. **Myth:** Alt. fuels and vehicles are more expensive to use.
 1. **Fact:** *They are often less expensive on a whole system or life cycle cost basis, depending on the application.*
2. **Myth:** Alt. fuels are difficult to implement.
 1. **Fact:** *Some alt. fuels are nearly seamless to implement. Others require more planning but can be done successfully.*
3. **Myth:** Alt fuels and vehicles are unproven, less reliable, and/or more costly to maintain.
 1. **Fact:** *Some are just as or more proven compared with new diesel engines and fuels.*



Biodiesel

- **Simple Manufacturing Process**
 - Biodiesel is vegetable oil without the glycerin.
- **Easy to Implement:**
 - Use in any diesel vehicle in your fleet.
 - Inspect tank then order pre-blended with petro-diesel.
 - Be prepared for possible filter plugging.
- **Outstanding Performance, Detergency, Lubricity**
- **Quality Assurance: ASTM D6751 and BQ-9000**
- **Winter cold flow can be managed reliably.**
- **It's comparable in price today.**
- **It's renewable – made in Ohio; supports Ohio's economy.**



Biodiesel Emissions:

Bus Chassis Dyno Testing (New NREL data)

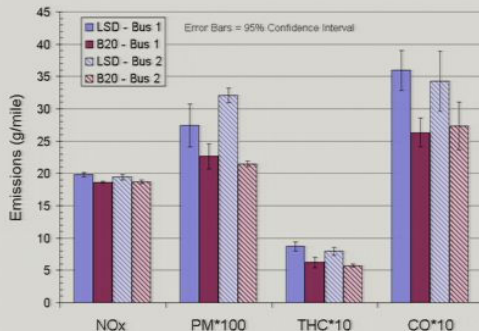
- **B20 vs. conventional diesel fuel**
- 2 in-use buses tested (40,000 lb GVWR)
- City Suburban Heavy Vehicle Cycle (CSHVC) at 35,000 lb inertia
- Cummins ISM 2000 Engine – No EGR

- **Expected reductions (g/mile basis)**

- PM \approx 24%
- HC \approx 40%
- CO \approx 32%
- Fuel Economy \approx 3%

- **Unexpected reductions in NOx**

- 4% reduction
- statistical confidence > 99%



Slide: Bob McCormick, NREL



Biodiesel Fleets

- Cincinnati METRO
- Toledo (TARTA)
- University of Toledo
- Ohio State University
- University of Michigan
- Several School Districts (in and out of state)
- ODOT & Other State DOTs
- Several private fleets
- Much more fleet information on www.biodiesel.org



Compressed Natural Gas (CNG) and Propane (LPG)

- Dedicated CNG Engines Available Today up to 375 HP / 1,000 ft/lb torque (LPG: 195 HP)
- Dual Fuel Conversions – Potential option for any size diesel engine
- Substantial Emission Reductions
- Both are reliable, tried and true option *today*
 - Maintenance... Performance...
- Negatives: range (CNG); access to fuel
- Refueling requires planning
 - Private developers and/or grants may eliminate cost factor for refueling
- Three Primary Cost Factors
 - Vehicles... refueling... fuel... maintenance
- New federal tax credits (for vehicles, fuel, stations)



Hybrid Electric

- Well suited to start/stop applications
- Still significant “incremental cost” – though tax credits can help
- Emissions:
 - Lower NO_x
 - Lower PM (but OC or DPF still recommended)
- Availability is increasing



Summing Up

- **Biodiesel** – Easiest to Implement; renewable
- **CNG** – Lowest emissions and life cycle cost, refueling requires planning or may be obstacle
- **Propane** – Greater range; HD not an option
- **Hybrids** – Good for start/stop, still high incremental cost
- *CFO Can Help with Implementation*